

## Geriatric fall-related injuries.

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### Abstract

**Background:** Falls are the leading cause of geriatric injury.

**Objectives:** We aimed to study the anatomical distribution, severity, and outcome of geriatric fall-related injuries in order to give recommendations regarding their prevention.

**Methods:** All injured patients with an age  $\geq 60$  years who were admitted to Al-Ain Hospital or died in the Emergency Department due to falls were prospectively studied over a four year period.

**Results:** We studied 92 patients. Fifty six of them (60.9%) were females. The mean (standard deviation) of age was 72.2 (9.6) years. Seventy three (89%) of all incidents occurred at home. Eighty three patients (90.2%) fell on the same level. The median (range) ISS was 4 (1-16) and the median GCS (range) was 15 (12-15). The lower limb was the most common injured body region (63%). There were no statistical significant differences between males and females regarding age, ISS, and hospital stay ( $p = 0.85$ ,  $p = 0.57$ , and  $p = 0.35$  respectively).

**Conclusion:** The majority of geriatric fall-related injuries were due to fall from the same level at home. Assessment of risk factors for falls including home hazards is essential for prevention of geriatric fall-related injuries.

**Keywords:** Accidental fall, geriatrics, injury, trauma registry.

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### Introduction

Improvements in healthcare are associated with increased life expectancy and high proportion of the elderly. It is projected by the United Nations that, by 2050, one-fifth of the world's population will be  $\geq 60$  years<sup>1</sup>. Falls are the leading cause of injury in the elderly<sup>2</sup>. Fall-related injuries have a great impact on the quality of life of old people and have huge medical and social costs<sup>3</sup>. There is limited information regarding geriatric trauma in our region. The United Arab Emirates (UAE) is a high income developing

country. Falls cause about 60% of injury in hospitalized geriatric patients in the UAE<sup>4</sup>. We aimed to study the anatomical distribution, severity, and outcome of geriatric fall-related injuries in Al-Ain city, UAE in order to give recommendations regarding their prevention.

### Methods

Al-Ain City is the largest city in the Eastern district of Abu Dhabi, with 463,000 in-habitants at the time of the study<sup>5</sup>. During the study period (March 2003 to March 2007), hospitalized trauma patients in our city were mainly managed in two major hospitals (Al-Ain and Tawam Hospitals). Eighty percent of them were treated at Al-Ain Hospital. All patients having an age  $\geq 60$  years who were admitted to Al-Ain Hospital or died in the Emergency Department due to falls were prospectively studied. Data was retrieved from Al-Ain Hospital Trauma registry. A subset group of this study was part of a previous study which was published before<sup>4</sup>. The Local Ethics Committee of Al-Ain Health district area approved the data collection. Studied variables included patient's demography,

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time of injury, type of fall, distribution and severity of injury, length of hospital stay, and outcome. The Injury Severity Score (ISS) was calculated manually as a global marker of body injury using the Abbreviated Injury Scale (AIS) 1998 handbook<sup>6</sup>.

### Statistical analysis

Incidence rates were estimated using 2005 census data<sup>7</sup>. Males  $\geq 60$  years old constituted 1.1% of the whole UAE population while females constituted 0.61%. Assuming that the structure of age of the population of Al-Ain City is similar to that for the entire UAE, Al-Ain city was estimated to have 5093 (0.011 X 463 000) males and 2824 (0.0061 X 463 000) females having an age  $\geq 60$  years<sup>5</sup>. Since 80% of trauma patients of our city were treated at Al-Ain hospital, the annual incidence of the fall-related geriatric injuries in the geriatric population were calculated as follows ((Number of injured geriatric patients in each category/study period in years)/estimated number of patient having an age  $\geq 60$  years in Al-Ain City in that category) X (1/0.8) X 100 000.

Mann Whitney U Test was used to compare two independent groups for continuous or ordinal data while Fisher's

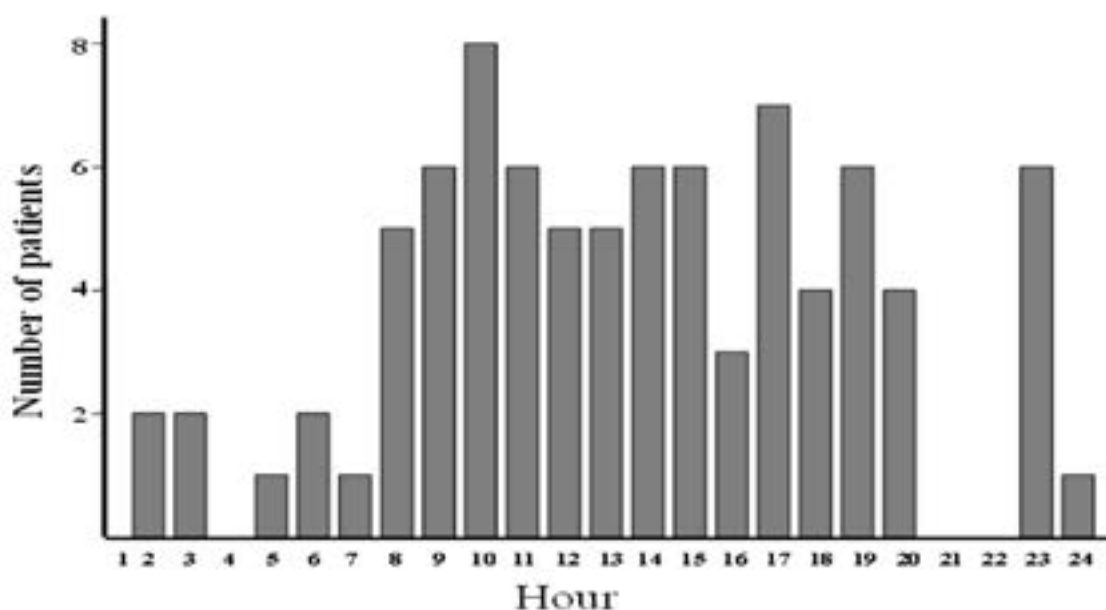
Exact Test was used to compare two independent groups for categorical data. Data were presented as mean (standard deviation), median (range), or number (%) as appropriate. Data were analyzed using the PASW Statistics 18, SPSS Inc, USA.

### Results

There were 3860 patients in the Trauma registry of Al-Ain hospital. Out of them, one hundred and fifty four patients (3.99%) were  $\geq 60$  years of age. In this group, 92 (59.7%) had fall-related injuries. Fifty six of them (60.9%) were females. The mean (standard deviation) of age was 72.2 (9.6) years. Forty seven patients (51.1%) were UAE nationals. There was no statistical significant differences between males and females regarding age, ISS, and hospital stay ( $p = 0.85$ ,  $p = 0.57$ , and  $p = 0.35$  respectively, Mann Whitney U test).

The estimated annual incidence of female geriatric fall-related injuries hospitalization in Al-Ain City was 620/100 000 population compared with 221/100 000 in males. The calculated overall incidence was 363/100, 000 population. Majority of falls occurred during daytime (74.4%) (Fig 1).

**Fig 1: Time distribution (hour) of hospitalized geriatric fall-related injured patients Injury (n = 92), Al-Ain Hospital, Al-Ain, United Arab Emirates (2003-2007).**



Seventy three (89%) of all incidents occurred at home and nine (11%) at streets. Eighty three (90.2%) patients fell from the same level, four (4.3%) from stairs, and five (5.4%) from more than one meter high. Five (5.4%) patients presented to the hospital after 24 hours of injury.

Eighty two patients (89.1%) had bone fractures. Lower extremity was the most common injured body region followed by the upper extremity and chest (**Table 1**).

**Table 1: Injured regions of hospitalized geriatric patients who were injured by falls, Al-Ain Hospital, Al-Ain, United Arab Emirates, 2003-2007, (n = 92)**

Body region	Number	%	Male n = 36	Female n = 56	P value
Head	9	9.8	2	7	0.47
Face	3	3.3	0	3	0.44
Neck	0	0	0	0	0.99
Chest	11	12	4	7	0.99
Abdomen	1	1.1	1	0	0.78
Spine	9	9.8	5	4	0.47
Upper extremity	11	12	5	6	0.88
Lower extremity <sup>a</sup>	56	60.9	20	35	0.65

<sup>a</sup> One male patient had bilateral tibia fracture

P value = Fisher's Exact Test

The femur was the most commonly fractured bone in the lower limbs (54.6%). The neck was the most frequent fractured region of the femur (80%) (**Table 2**).

**Table 2: Lower limb and pelvis injuries of hospitalized fall-related injured geriatric patients, Al-Ain Hospital, Al-Ain, United Arab Emirates, 2003-2007 (57 injuries in 55 patients) <sup>a</sup>**

	Number	%	Male n = 20	Female n = 35	P value
Hip fracture	7	12.7	2	5	0.99
Femur fracture	30	54.6	14	16	0.14
Neck	24	43.6	10	14	0.66
Shaft	6	10.9	4	2	0.24
Tibia fracture <sup>b</sup>	6	10.9	3	3	0.75
Fibula fracture	1	1.8	1	0	0.72
Patella fracture	5	9.1	0	5	0.19
Ankle fracture	5	9.1	0	5	0.19
Foot fracture	1	1.8	1	0	0.72
Soft tissues	2	3.6	1	1	0.99

<sup>a</sup> Two patients had two bones fractured at the same limb

<sup>b</sup> One patient had bilateral tibia fracture

P value = Fisher's Exact Test

Pelvic fractures were more common in females (14.3%) compared with males (10%) but this was not statistically significant ( $p = 0.99$ , Fisher's Exact Test). Five patients had patella fractures, all were females.

Fracture of the radius was the most common upper limb injury (nine patients); five of them had Colles' fracture. In nine patients with head injury, five (55.6 %) had intracranial haemorrhage or skull fracture. In eleven patients with thoracic injury, nine patients (81.8%) had fractured ribs.

The median (range) ISS was 4 (1-16) and the median (range) GCS was 15 (12-15). Four (4.3%) patients were admitted to the Intensive Care Unit. The mean (range) hospital stay was 11.7 (1-150) days. No patients died in our study.

## Discussion

UAE has a very young population. Only 1.7% is 60 years or older<sup>7</sup>. Our study has shown that hospitalized geriatric trauma patients constitute 4 % of all admitted trauma patients. This is more than their percentage in the community. Minor trauma in the elderly may lead to severe injuries requiring hospitalization<sup>8</sup>. Fall was the main cause of geriatric injury<sup>9-12</sup>. The estimated incidence of hospitalization caused by geriatric falls in our city (363/100 000) is less than others<sup>2,13</sup>.

Non-UAE nationals represent 82% of the general population in the UAE. Most of the expatriate workers retire at the age of 60 and return back to their home countries. At this age, UAE nationals, represent 52% of the geriatric population<sup>7</sup>. Our study has shown that 51% of our patients were UAE nationals which is similar to that percentage.

Males represent 63.4% of the population having an age of 60 years or more in the UAE<sup>7</sup>. Similar to other studies, we have shown that injuries caused by falls are more common in old females<sup>2,3</sup>.

Fall from the same level is the most common type of fall in the elderly<sup>10</sup>. Even low energy trauma in the elderly can be serious because they have decreased physiological reserve and associated comorbidities<sup>8,14</sup>. It is important to note that age alone does not reflect the patient's physiological status and each patient should be considered individually<sup>9,15</sup>.

Hazards at home, such as uneven surface or slippery floor, can increase the risk of falls in the elderly<sup>11,16</sup>. Our study has shown that majority of falls (89%) occurred at home at daytime, the time of greater activity, similar to other reports<sup>10,17</sup>. The most common anatomical injured region was the lower extremity, and the most common fractured bone was the femur<sup>18</sup>.

Eighty percent of the fractured femurs were in the neck which is most likely related to osteoporosis<sup>19</sup>. Similar to others, pelvic fractures were more common in females compared with males<sup>20</sup>. This was not statistically significant possibly due to the small sample size (Type I statistical error).

The patella can be easily fractured in osteoporotic patients<sup>21</sup>. All patients with fractured patella were females in our study. Fractures of the ankle in females are likely to be related to overweight rather than osteoporosis<sup>20</sup>. The radius was the most common fractured upper limb bone, which is also related to osteoporosis<sup>21</sup>.

Severe head injury in the elderly is more common compared with the young population<sup>8</sup>. The reduced brain mass and adherence of the dura to the skull increase the risk of intracranial haemorrhage in the elderly<sup>22</sup>. Our study showed that more than 50% of those who had head injury had either intracranial haemorrhage or skull fracture. Contrary to others<sup>18</sup>, we did not show statistical significant difference between males and females in the upper extremity or thoracic injuries.

About 5% of our patients had delayed presentation for more than 24 hours. The socioeconomic status of geriatric patients with lack of medical attention can lead to delayed presentation and poor clinical outcome. Falls from non-ground level can lead to more serious injuries<sup>23</sup>. No patients died in our study. This may be related to our small sample size or because we didn't include patients who died before arriving to the hospital. Similar to others, there were no statistically significant differences between males and females regarding injury severity and hospital stay<sup>10</sup>. This is expected and can be due to selection bias for those who were admitted.

Risk factors for falls were multifactorial<sup>24</sup> including age, cognitive status, previous falls, balance problems, medications, hyponatremia, problems with hearing or vision, home hazards, and osteoporosis<sup>11,25,26</sup>. Many elderly who

fall develop a fear of falling. This causes reduction in their activity which in turn increases the risk of falling<sup>11,27</sup>. Falls in the elderly have significant morbidity and mortality and are very costly<sup>28</sup>. Geriatric-specific triage criteria and development of geriatric trauma centers may reduce morbidity and mortality of geriatric trauma<sup>29,30</sup>.

Many falls could be prevented by defining their risk factors<sup>31</sup>. Risk screening and assessment can identify older people who are at increased risk of falls<sup>31</sup>. This screening should also include the active elderly population who are at risk of non-ground level falls<sup>23</sup>. Fall prevention should include balance training, physical activities, medication management, and environmental and home hazards modification<sup>32</sup>.

Home was the most common site of falls in our study. Elimination of home hazards, such as slippery floors, uneven surface, and inadequate lighting, can decrease the risk of geriatric falls<sup>16</sup>. Low stiffness floors reduce the fall-related femoral impact by up to 50% without impairing the balance<sup>33</sup>. Vitamin D supplementation decrease the long term rate of fall related injuries<sup>34</sup>.

## Conclusion

Fall-related injuries are the main cause of hospitalization of geriatric trauma patients. Majority were at home and at the same level. Assessment of the risk factors for falls including home hazards is essential for prevention of geriatric fall-related injuries.

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## Conflict of interest

None to declare.

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